Private Signals: An Investigation of Electrodermal Activity in Novices and Experts in *World of Warcraft*

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Abstract

This paper outlines a pilot investigation of expert and novice Electrodermal Activity (EDA) during game play sessions in World of Warcraft. Players exhibited a wide range of results, producing further questions that would invite further the further investigation of game play with EDA.

Author Keywords

Electrodermal Activity, Gaming, Evaluation

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Design, Experimentation, Measurement,

Introduction

Recent developments in the hands on learning found in games has produced a great deal of enthusiasm for learning games from government, industry, and foundations. With this attention has come a variety of perspectives on how to best measure the learning gains produced by games. One of the most frequent

arguments about the benefits of games touts their ability to better engage young people in a topic through interactivity with complex and compelling systems. This has led many funders to seek out an "engagement pedometer" of sorts—a means to understand with certainty whether or not a child is engaged in the material he or she should be learning. Some measures in informal science education fields (such as museums) have relied on whether the researchers believe, through observation, that children are paying attention to a lecture or audio-visual display or how long they linger at a particular exhibit. A "pedometer" would theoretically give a more reliable measure of a child's engagement. As sensors to measure Electrodermal Activity (EDA) have become more readily available and portable (including the Affectiva Q Sensor used in this study), and as the science to understand the connection between the signals and human feeling and thought is advanced, EDA seems like a natural place to look for the "engagement pedometer."

In this study, I sought to both increase my understanding of EDA as a measure of human activity, as well as to understand what relationship EDA might have to learning. Because engagement is a difficult idea to define, I sought to instead understand whether experts and novices produced different types of signals when encountering a game with a famously wide gap between novice and expert activity: *World of Warcraft* (Blizzard, 2004). My hypothesis was that, because expertise is, "information so finely adapted to task requirements that it enables experts to do remarkable things with intellectual equipment that is bound by the same limitations as that of other mortals," (Bereiter & Scardamalia, 1993), expert players would show less exertion overall, even if performing the most

challenging tasks in the game, than novices, who would be using their intellect to develop an understanding of the game. This is in part because previous studies have shown that EDA responds to mental or physical exertion and difficult motor activity (Edelberg & Wright, 1964; Kahneman, 1969; Pugh et al., 1966).

In order to really understand what the four players I studied were learning and experiencing during the experiment, I first measured their EDA while engaging in a typical experience for their relative level of expertise (creating a character and beginning adventuring for novices; participating in 10 person "raids" for experts), then measured their EDA while I showed them video tape of their play experience and asked them about their experience. By choosing qualitative methods, this study favors an attempt to understand experience and makes no generalizable claims. It is hoped that the findings and the further questions they inspire can be researched at greater length.

Conclusions
Generally, the study has raised more questions than it has answered. There are remarkable findings, like the "rhyming" shapes of Subject 1's reactions to her gameplay footage—while watching her footage, the shape of her EDA signal looks very similar to the co-incident game play signal. Subject 3's signal while playing the game didn't muster much signal, but her signal while talking about her character produced dramatic signals. Novelty seems to have elicited stronger responses from the novices than the experts, but the data from Subject 2, one of the experts, is a flat, steady increase and so confounding and certainly far from saying anything conclusive about expertise.

Nevertheless, Subject 4's overall flat response during an animated and engaged discussion about an area of shared expertise may indicate that Bereiter and Scardamalia's assertions about the nature of expertise are correct (i.e. that experts think within mortal limits because they replace intellect with knowledge).

This all hinges on a further investigation of cognitive load. Prof. Picard related that most studies of cognitive load are conducted in social situations that may be potentially embarrassing such as counting backwards in front of researchers. Compellingly, Subjects 1 and 3, who learned the most during this study, related that much of their learning was in downward curves or lulls of their EDA signals. Indeed, much of the activity seen at the beginning of Subject 1's session, while learning and fighting with the game's interface, could be described as frustration and embarrassment, not cognitive load. Subject 3 seemingly responds more to success and feeling valued and being able to share her expert opinions than during her moments of learning and investigation.

This is clearly just the tip of the iceberg on this interesting topic. Further, cleaner, and more quantitative research might be done in order to inquire into the difference between cognitive load and feelings of personal value during a learning experience.

Biography
Jason is an MIT Media Lab Research Assistant in The Education Arcade, affiliated with the Scheller Teacher Education Program and the Comparative Media Studies department at MIT. His research focuses on the development of learning games and experience, as well as understanding of the learning that occurs in play. He is particularly interested in collaborative and competitive play, as well as large organizations and systems thinking. Recent projects include Poikilia (gambit.mit.edu/loadgame/poikilia.php), Vanished (vanished.mit.edu), and an as yet unnamed Bill and Melinda Gates Foundation funded Massively Multiplayer Online Game for science and math learning. He holds a B.A. in Film Studies from Wesleyan University, and a M.Ed. from the Harvard Graduate School of Education's Technology, Innovation and Education program.

References
[1]   Bereiter, C., & Scardamalia, M. (1993). Surpassing Ourselves: An Inquiry into the Nature and Implications of Expertise. Chicago, IL: Open Court.

[2]   Blizzard Entertainment. (2004). World of Warcraft [MMORPG]. Blizzard Entertainment. Retrieved in November 2011 via game client.

[3]   Edelberg, R., & Wright, D. J. (1964). Two galvanic skin response effector organs and their stimulus specificity. Psychophysiology, 1(1), 39-47.

[4]   Kahneman, D., Tursky, B., Shapiro, D., & Crider, A. (1969). Pupillary, heart rate, and skin resistance changes during a mental task. Journal of Experimental Psychology, 79(1p1), 164.

[5]   Pugh, L. A., Oldroyd, C. R., Ray, T. S., & Clark, M. L. (1966). Muscular effort and electrodermal responses. Journal of Experimental Psychology, 71(2), 241-248.